History & Heritage

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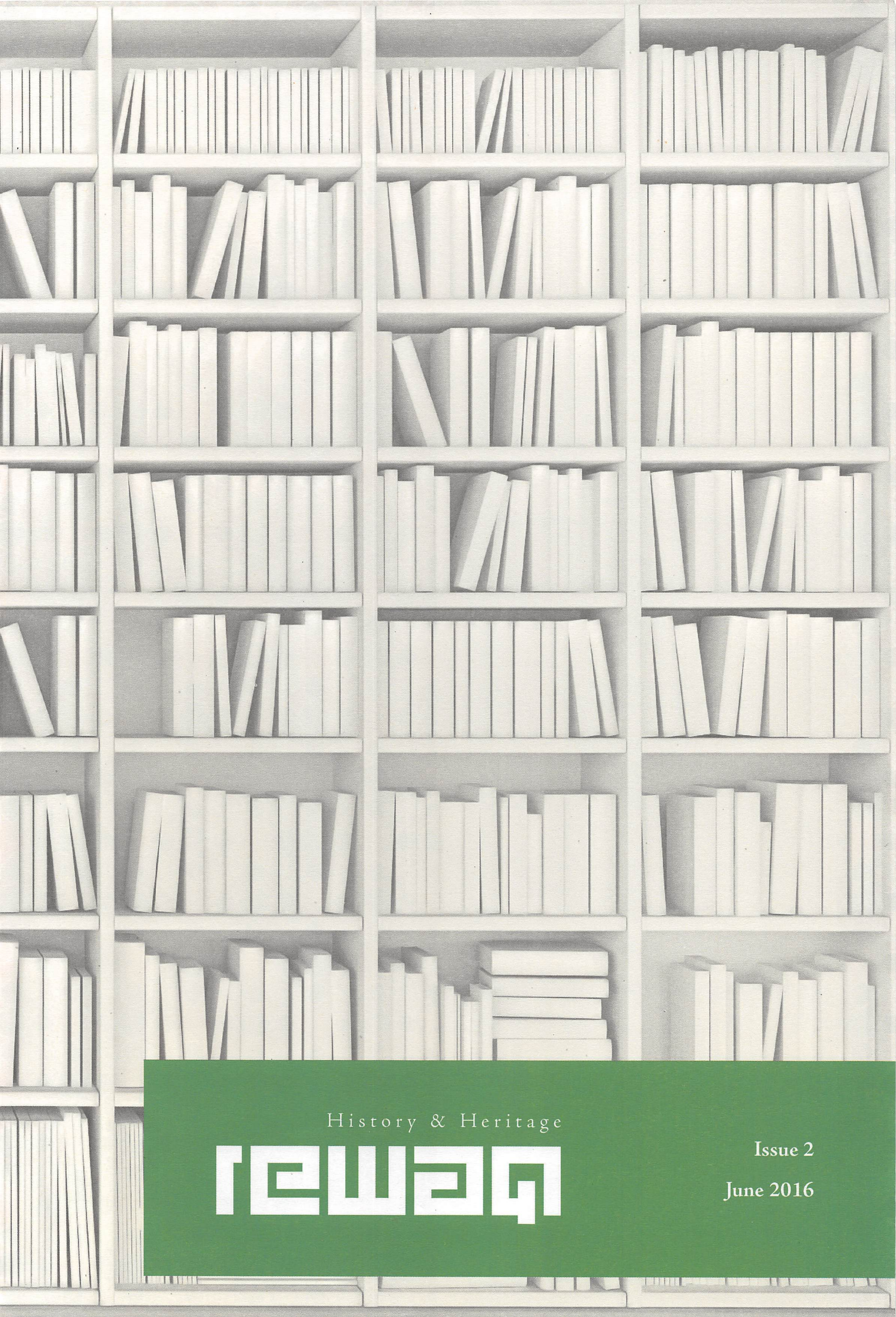

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1- The material should not be previously published.

2- The material should meet the conditions of methodological scientific research.

3- References should be inserted automatically in sequential ordering.

4- Images and illustrations may be inserted provided that they are original, and the author shall obtain their publishing rights.

5- Terminologies of foreign languages should be written in their original language.

6- The material should be written on A4 word document using Arial font, and it shall not exceed thirty pages including images, illustrations and other attachments.

7- Contributions shall be subject to secret refereeing by specialists.

8- The journal shall not give reason why the material was not accepted for publication and is not required to return it.

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11- The author shall provide a summary that does not exceed fifty words, and he shall also provide an abstract biography and 4x6 cm photo of the author.

12- The author shall receive one free copy of the issue in which his article is published.

INTRODUCTION

In the time of information flow and its spread through various source of knowledge, the need for the quality and originality of the source becomes an aim sought by seekers of facts; that is the role played by refereed scientific journals and sought by some academic centers that adhere to authentic values, which control and regulate the scientific research.

In its second issue, and after receiving many academic researches and adopting the method of objective refereeing, Rewaq is proud that its first and foremost subject, the received researches adhere to the standards of scientific quality. And we consider this to be the purpose for which we issue it.

This issue of Rewaq journal contains scientific researches and articles that constitute new additions to the stock of knowledge. In the context of his scientific project that aims at showing the contributions of Arab and Islamic civilization to the human civilization, Michael Morgan reviews in his research entitled "From Arabia to Silicon Valley" aspects of these contributions, through which the first thinkers formed a real image of the modern world.

In another realm of civilizational dialogue realms, Prof. Jamal Hajar presents an image of the intellectual meeting between the politician and the philosopher; and how each of them perceives peace as a humane demand.

Professor Youssef Abdullah reviews a number of literary imagery, through pre-Islamic archeological examples in Arabia, exceeding the matter of doubt in pre-Islamic poetry.

And in his research entitled "Derkaouia School in Morocco from Criticizing and Opposing the Makhzen (Governing Institution) to Rejecting and Resisting the French Occupation" Prof. Qasim Al-Hadk presents an image of the modern political history of Morocco.

Professor Jalal Zine El Abidineadds in his research and image of "Political Violence in Morocco after Independence" handling a critical period in the contemporary history of Morocco.

Professor Ali al-Sayed takes an interest in the character of "Humphrey II: Constable of the Crusader Kingdom of Jerusalem"; the character that played a clear part in the Crusader history in the Levant.

Rewaq hopes that this issue, with its equable scientific researches, will add a new branch of authentic knowledge branches.

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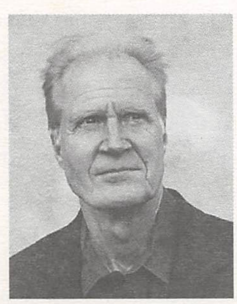
Cover of Book of Animals

From Arabia to Silicon Valley:
how early thinkers intuited the modern world



Michael Hamilton Morgan

Michael Hamilton Morgan is a former US diplomat and a researcher of Arab and Islamic heritage. He graduated from the University of Virginia. He has been a keynote speaker at the US National Archives and the British Parliament. From 87-1980 he was the Deputy Staff Director of the U.S. Advisory Commission on Public Diplomacy. His book Arabia: In Search of the Golden Ages won the Silver Nautilus Award. Among his other books about the golden age of Arabia, the legacy of Arab and Muslim scientists and popular history, the best known include Lost History and Arab Science: Journey of Innovation.

All images in this article were chosen by the writer

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The article focuses on certain unrecognized intellectual processes of early Islamic societies that were the precursors of many modern scientific and intellectual developments in Europe, the West, and the modern digital world.

It is one of the tragic ironies of current historiography that ArabMuslim culture, which helped lay many of the foundations of the modern world, is today stereotyped as intellectuallybackward, both historically and in the present. Even many contemporary Arabs have come to accept that as truth.

Western thinkers generally agree that the key advances that define modernity -- including the empirical scientific method, higher mathematics, evidence-based medicine, physics, astronomy,chemistry, biology, Darwin's theoryof natural selection of species and many more – are traced to discoveries made in Renaissance and Enlightenment Europe starting in the year 1500 CE. Arab and Muslim names have no part in that story.

But a more inclusive reading of history shows this perspective is a seriousomission of fact. It leads to a false historical narrative of intellectual and cultural superiority, when in reality, thepathof human discovery transcends artificial time frames, borders, races, cultures and religions. Moreover, the omission of Arab Muslim contributions to modernity-- contributions which often happened 500 to 800 years before the era of European discovery -- contributes to the negative stereotyping of today's Arab Muslim culture as intellectually closed andsomehow separate from the flow of human discovery.

Compounding this error is the rise of Eurocentric intellectual superiority and exclusionary thinking that traces back about 200 years, to the high period of European colonialism. As Johann Heinrich Zedler in 1741 wrote,"even though Europe is the smallest of the world's four continents, it has for various reasons a position that places it before all others ... its inhabitants have excellent customs, they are courteous and erudite in both sciences and crafts."1

That sense of superiority is especially ironic, considering that during the period 800-1500 CE, educated Europeans stood in awe of ArabMuslim discoveries and inventions, often using centuries-oldtexts from the Middle East and Persia as the most advanced sources for multiplefields, like mathematics, medicine and astronomy.

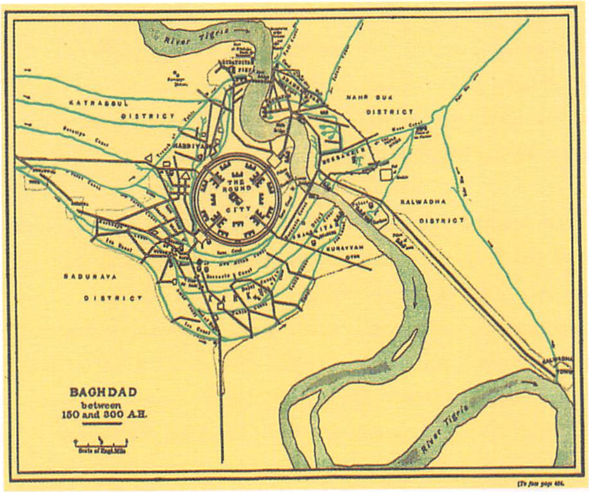
Even the most charitable of mainstream Western historians will often only concede that the main value of the golden age of Arab Muslim culture was that it"preserved" the earlier discoveries and ideas of the Greeks and Romans by translating their original manuscriptsfrom Greek andLatin into Arabic, holding those manuscripts until Europe was ready to re-absorb them centuries later. Historian George Saliba of Columbia University calls this the"refrigerator theory" of Arab Muslim history. In other words, Arab culture had no original inventions or ideas of its own, but merely stored older Greco-Roman discoveries.

There is not enough space in the article to understand why this distortion of the historical record has happened. It results from a combination of ethnocentrism, the passage of more than 1000 years, short historical memories, the loss and destruction of ancient manuscripts and libraries, and the sad reality that"history is written by the victors."

But if one wishes to fully understand our modern world, one must understand where civilization comes from. Credit and recognition must be given not only those who speak familiar languages and are closer in culture and time; acknowledgement must also be given to those who are dead andgone, who did not benefit from intellectual property protection, who had names and who wrote in tongues that are hardfor Westerners to understand and who were sometimes inspired to make their discoveriesby the faith of Islam.

Caliph Harun_al Rashid receiving the delegation of Charlemagne 802, byKockert

Understanding the historical Arab Muslim intellectual and cultural framework.



William Muir

Few people today appreciate the similarity in intellectual and cultural frameworks that led to the discoveries of the European Renaissance/Enlightenment, as well as to the breakthroughs of the earlier Arab Muslim golden ages in Baghdad, Cairo, Cordoba, Damascus, Sicily and North Africa and later Muslim advances in Istanbul, Isfahan, Delhi, Bukhara and many others.

But in fact, these European and Easterncultural periods, separated by centuries in time and thousands of miles, were marked by similar characteristics.

First, in both cultures there was asustained period of economic growth that created wealth and the rise of cities. For Europe, that growth resulted from technological innovations like the trade guilds, printing press, the Industrial Revolution and then the age of colonial conquest, which sent the riches of older civilizations like Egypt, India, China and Africa flowing back to the European cities of Venice, London, Paris, Madrid and others.

For the Arab Muslim world, that growth and wealth came from the spectacular expansion of Arab Muslim culture in 632 CE from an area fairly confined to the Hijaz – Mecca and Medina in Arabia – to 732 CE,when it encompassed a vast region

stretching from Spain and Morocco to NorthIndia and Western China. This period of expansion and conquest generated new trade routes, industries and theflow of taxes and war booty back to the Muslim imperial capitals. By the year 1000 CE, modern historians believe that Baghdad may have had 2 million inhabitants, with asphalt paved streets, streetlights, libraries and hospitals, when London and Paris struggled to support only 10,000 inhabitants each.2

These surges of wealth and urbanization led to the rise of other cultural values that were common to the early Arab Muslim world, and then to the later rise of Europe; **in particular, a similar climate of intellectual and cultural openness in both cultures.** Just as the rising late medieval universities in Italy, England, France and Germany – often inspired by older universities in the Arab world -- were dedicated to understanding the world, so were the olderuniversities in Iraq, Cairo, Persia, North Africa and Spain. As Arab thinker al Kindi wrote: *"We ought not to be embarrassed of appreciating the truth and of obtaining it wherever it comes from, even if it comes from races distant and nations different from us. Nothing should be dearer to the seeker of truth than the truth itself, and there is no deterioration of the truth, nor belittling either of one who speaks it or conveys it."*

There was also a parallel culture of invention.Just as Leuwenhook invented the first recorded microscope and could finally see bacteria and cells, Ibn al Haytham of Cairo rediscovered and improved the Chinese camera obscura 600 years before Leonardo da Vinci, alZahrawi ofCordoba invented 200 medical instruments 1,000 years ago like the obstetrical forceps, many of which are still in use today, al Jazari wrote his *The Book of Knowledge of Ingenious Mechanical Devices: Kitábfíma'rifat al-hiyal al-handasiyya*, a treatise on mechanical intelligence and robotics in Kurdish Turkey in the early 1200slaying the foundation for the Industrial Revolution that would come nearly 500 years later in Europe.

There was also a common culture of intellect,using one's brain to unlock the secrets of God's universe,and of what it means to be human.

There was a similar culture ofasking hard questions, and of questioning assumptions.As Ibn al Haytham said,*"From the statements made by the noble Shaykh, it is clear that he believes in Ptolemy's words in everything he says, without relying on a demonstration or calling on a proof, but by pure imitation (taqlid); that is how experts in the prophetic tradition have faith in Prophets, may the blessing of God be upon them. But it is not the way that mathematicians have faith in specialists in the demonstrative sciences."*3

In the Arab Muslim golden age and Renaissance Europe, there was a common practiceof improvisation and assimilation. The Arabswho conquered half theworld in 100 years, previously a non-urban and often nomadic people, found themselves administering hugecities and civilizations like Persia, Byzantium and India. The victorious Arabs could have tried to force their desert ways ontothese other cultures, which would have been a tragedy and probably a failure.But instead, they assimilated the best of allthese oldercultures, and created something new.

Andthere wasa parallel culture ofleadership and philanthropy. Just as Lorenzo de Medici and many other wealthy Europeans personally funded inventionand discovery during the Renaissance and Enlightenment, so did Arab-Muslim patrons like the Umayyad andAbbasid dynasties in Spain and Iraq, the Fatimids in Cairo, the Ottomans in Istanbul and many others, fund the discoveries of thinkers like Ibn Sina, alZahrawi, al Khwarizmi and hundreds of others.

Where did these common European-Arab practices come from, in the Arab Muslim context? As said above, someof themarose as the result of economic and population growth and conquest. But some of them foundsources in the newreligion ofIslam. Drawing partly on certain statements attributed to the Prophet about the importance of knowledge, Islam became profoundly intellectual and global. It was universal and inclusive, welcoming all colors and nationalities. Like European colonial culture centuries later and the digital world today,the culture ofIslam eventually stretched from Spain to the Philippines... the entire width of Eurasia. Its beliefs required thefaithfultofind the direction of Mecca,to formalize the calendar, to navigate the seas and deserts for trade andfor the hajj, meaning astronomers and mathematicians had to figure out how the sun, moon and stars could mark the seasons and show the way to the intended destination.

Al Jazari'shydropowered chain pump.

al Khwarizmi from a Soviet postage stamp 1983

a page from Al Khwarizmi's "Compendious ..."

Arab mathematical foundation of the modern digital world

While there are many Arab Muslim discoveries that underpin the modern world, perhaps the most important one is higher mathematics. Higher mathematics, and in particular one algebraic mathematical tool known as the algorithm,enable21st century innovations like the writing of software and applications, financial market modeling, data mining, Google searches, space travel and nuclear physics.

The average Western high school student probably believes that modern higher mathematics, as in the case of geometry, comes from the Greeks and Romans. But that view is seriouslymistaken, and a disservice to the great mathematical thinkers of the Arab Muslim world, in particular Mohammed al Kwharizmi, who did his most important work at the *Bayt al Hikmat* in Baghdad under the patronage of the Abbasid caliph al Mamunibn Harun.

Mamun was a fierce intellect in his own right, allied with the Mutazilischool of Islamic thought. The Mutazilites argued that God's truth could be best determined through the use of reason. They were known as Islamic rationalists. They found themselves locked in angry debate with their opponents, the Hanbalischool of traditionist thinkers, who argued that God's truth came through revelation alone.

This religious debate turned very political, and shaped the future of Sunni Islam. In support of his cause, Mamun soughtto gather the greatest thinkers to find God's truth via mathematics, astronomy, science and medicine in what may have been the world's first "think tank", the *Bayt alHikmat* or House of Wisdom in imperial Baghdad.

One of the thinkers recruited by Mamun was the Persian mathematician, astronomer and geographer Muḥammad ibn Mūsā al-Khwārizm, known today as al Khwarizmi. The impact of al Khwarizmi's discoveries in modern lives are probably greater than those of Albert Einstein. This is not to diminish Einstein, whose theories of relativity and space-time are still changing our views of the universe almost 100 year after hewrotethem.

But alKhwarizmi's discoveries are ones that the world usesor benefits from every day.

First, al Khwarizmi began his work for Mamun by digging into the scholarly archives assembled by Mamun's father Harun alRashid. There hefound papers brought from India to Baghdad by the Indian thinkerKanka (Ganga) about 30 years earlier. In the papers were the much older discoveries of the Hindu mathematican Brahmagupta.

In the writings of Brahmagupta, first al Khwarizmi found a concise and efficient new method of representing mathematical equations using numerical symbols. At that time, Arab mathematicians expressed equations using written words,which was hugely cumbersome and slow. Khwarizmi liked the Indian method,which he adopted, and which is still usedtoday. The Indian symbols 0-9 that he found and adopted are now called the "Arabic numerals" in the West.

He also noticed that Brahmagupta used a very clean method of organizing values, based on multiples of 10, a system now known as the decimal system. Until that time, assorted platforms had been used to organize values. One still in limited use today, developed by the Sumerians and Babylonians, was the sexagesimal system, based on multiples of 60, which is used today in measuring time (60 minutes to the hour) and geography (360 degrees to thecompass).

Al Khwarizmi realized how much more efficient the decimal system was. Thanks to him, theworld is now based on decimal computations.

Among those Indian symbols now usedgloballyhe saw a symbol that initially he did not understand. It was the symbol representing the number zero, which did not exist in any of the mathematic systems then being used in the Arab caliphate. In the Indian manuscripts it was represented with a dot (.)

It took him some time to figure out the meaning of zero. And then he realized it was a symbolfor nothingness. And such an abstract concept now opened up the wholeworldof higher mathematical abstraction, taking mathematical thought far beyond the confines of Greek geometry,whichwas about measuring space, not abstraction.

Following alKhwarizmi'srediscovery of the zero came his "rediscovery" of the negative numbers. This was another form of pure abstraction, since no negative number can be seen or measured, except by abstract methods.

But the genius of al Khwarizmi is that hedid not stop at using the methods that Brahmagupta had found centuries before in India. He took these rediscoveries and began to apply them to various mathematical problems.

His first mathematical invention he calledal jabr, or "restoring" in Arabic. It was used for problems like calculating inheritances according to emerging Islamic law. Today the world knows this as algebra. The word comes from his book The Compendious Book on Calculation by Completion and Balancing (Arabic: الكتاب المختصر في حساب الجبر والمقابلة al-Kitāb al-mukhtaṣarfīḥisāb al-jabrwal-muqābala), written approximately 830 CE.

More than 300, years later, according to L.C. Karpinski, the book was translated into Latin as *Liber algebrae et almucabala* by Robert of Chester (Segovia, 1145) and also by Gerard of Cremona. An Arabic copy remains at Oxford, whilea Latin translation is kept in Cambridge.4

But al Khwarizmi went much farther than algebra. He began developing algebraic tools for managing very complex sets of data. These were used in calculating things like lunar and planetary tables, which were important for navigation and religious calendars.

Al Khwarizmi did his work in the early part of the 800s CE. His writings gradually spread through the Muslim world and beyond.

They began to move into Europe via Italy and Spain beginning in about 1150 CE, 300years after al Khwarizmi's death. The European mathematicians, just awakening from the centuries-long silence after thefall of Western Rome in 467, were immediately dumbstruck by the discoveries and rediscoveries that al Khwarizmi had made.

His higher algebraic tool for handling complex data was named after him. In Latin, it was called *algoritmi*, sometime after the year 1100. As Europe grew and evolved, algoritmi in Latin

Jabir from a medieval European manuscript

Ibn al Haytham

became "algorithm" in English, a memorial to the brilliant Baghdadinventor even after the worldforgot his name.

Al Khwarizmi's discoveries and rediscoveries underpin nearly every part of the modern world ... from basic arithmetic and symbols, to every bit of information technology computation, astronomy, financial transactions, space traveland exploration. If intellectual property protection had existed in his day, his discoveries would now be worth many trillions of dollars.

Birth of the modern scientific method: Europe or Arabia?

The modern scientific method – the process of developing a hypothesis and then testing it against measured and recorded reality – is an underpinning of the digital world. It enables research, discovery and invention in every academic field,from chemistry to physics to medicine. It is the highest expression of rationalism, and has allowed the technological and medical breakthroughs of the last 500 years, from the discovery of the characteristics of the earth's orbit to clinical trials of pharmaceuticals to silicon-based information processing.

While mainstream Western history of science does sometimes mention certain early methods of modern scientific experimentation, such as in the works of Aristotle,Ibn alHaytham in 11th century Fatimid Cairo and others, mainstream Western history of science still attributes the rise of the modern scientific method to certain intellectual discoveries and innovations in Europe in the 17th century CE. According to the Oxford English Dictionary, the scientific method is *"a method or procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses."* 5

But is that correct?

Statements of the modern scientific method can be found in the very earliest writings of the first Muslim-sponsored scientific thinkers, 1200 years ago.

Abu MūsāJābir ibn Hayyān, orJabir (721-815 CE), believed to have been a Persian of Arab origin, is often depicted as thefather

of modern alchemy. In Western translation, the word "alchemy" is associated with magical or spiritual science ... the search for the elixir or philosopher's stone that could transform lead into gold, a magical quest which so captivated medieval Europeans.

But this exclusive association of Jabir's alchemy with magic is at best incomplete. The English word alchemy is a distortion of its original meaning in Arabic, *al kemie*, or "the chemistry."

In fact, it could be argued that Jabir is also one of the early fathers of modern chemistry, and of the modern scientific method.

Thatis not to say that Jabir and many other Arab Muslim thinkers were not toying with the idea of magical or spiritual chemistry, in parallel to theirwork with evidence-based chemistry. But it is unfair to devalue the scientific work of Jabir for this reason, since even the great English empiricist Sir Isaac Newton, father of the modern understanding of gravity nearly 800 years after Jabir, was also a dabbler in alchemy.

In fact, Jabir, who lived so long ago, a generation older than alKwharizmi but also working for the Abbasids in Baghdad and the *Bayt al Hikmat*, was the first Arab Muslim to voice something akin to the scientific method. As he is believed to have written,

*"The first essential in chemistry is that you should perform practical work and conduct experiments, for he who performs not practical work nor makes experiments will never attain the least degree of mastery. But you, O my son, do experiment(s) so that you may acquire knowledge. Scientists delight not in an abundance of material: they rejoice only in the excellence of their experimental methods."*6

Historian Paul Kraus goes further in recognizing the empirical nature of Jabir's method:

"The study of the Greek alchemists is not very encouraging.An even surface examination of the Greek texts shows that a very small part only was organized according to true experiments of laboratory; even the supposedly technical writings, in the state where we find them today, are unintelligible nonsense which refuses any interpretation.

It is different with Jabir's alchemy. The relatively clear description of the processes and the alchemical apparatuses, the methodical classification of the substances, mark an experimental spirit which is extremely far away from the weird and odd esotericism of the Greek texts.The theory on which Jabir supports hisoperations is one of clearness and of an impressive unity. More than with the other Arab authors, one notes with him a balance between theoretical teaching and practical teaching, beween the 'ilm and the 'amal. In vain one would seek in the Greek texts a work as systematic as that which is presented for example in the Book of Seventy." 7

Esteemed Greek thinkers, while certainly aheadof their times, very often violated therules of measuring a hypothesis against the observed reality of testing, measurement and experimentation. A perfect example is the Greek astronomical and optical thinker Ptolemy (100-170 CE). Ptolemy was so revered by the early Arabs that it is said that when Caliph al Mamun defeated the Byzantines in battle and signed a treaty of peace, part of the tribute he received from the Byzantine emperor was acopy of Ptolemy's Almagest.8 Ironically, a number of Ptolemy's untested hypotheses survived as Arab scientific doctrine -- until they were disproved centuries later by Arab thinkers.

Themost glaring examplewas Ptolemy's theory of light, which Ptolemy said was a ray emanating from the human eye and illuminating the object observed. How that theory could withstand the actualities of such visual phenomena as sunrise and starlight is hard to imagine. But it did survive until the time of Ibn al Haytham(965– c. 1040 CE).

As Ibnal Haytham wrote,

*"The duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and ... attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency."*9

True to his own statement of the role and duty of a scientist, in his seven volume *Book of Optics* (Arabic: Kitāb al-Manāẓir (كتاب المناظر) and other works,Ibn al Haytham painstakingly demonstrated and recorded that light was a ray emanating from a light source, striking the object, and being perceived by the eye. This conclusion required him to also understand the structure and function of the human eye. That kind of incremental discovery, of

which he made hundreds, would gradually begin to impact human history and development, but often notuntil his inventions were rediscovered or unknowingly replicated later in Europe.

Another untested hypothesis of Ptolemy, equally disproved by Ibn al Haytham, was Ptolemy's equant, a mathematical formula which was used to work around an even greater underlying error in understanding the relationship and movement of the solar system.

The misunderstanding at the root of Ptolemy's error was his geocentric view of the universe, in which he argued that the earth sat at the center and everything else including the sun orbited around it.

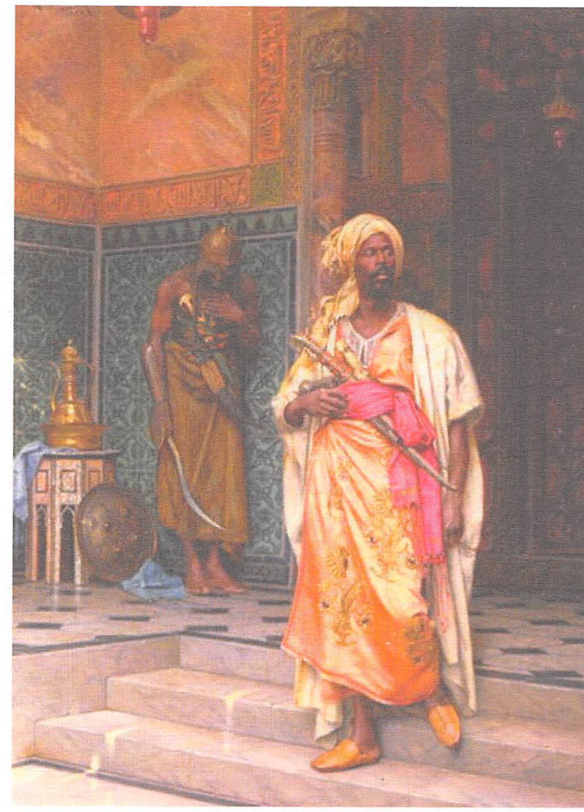
Because civilizations from the beginning of time had been fascinated by the heavens and the movements of the heavenly bodies, various theories had arisen to explain why the bodies moved as they appeared to do. Unfortunately none of the theories discovered or intuited that the earth was orbiting the sun; if they had, celestial movements would have made more sense.

Ptolemy did not discover the truth. Instead, he developed a very complicated mathematical model to explain his error in understanding the position and movement of the planets in the solar system.

Ibn al Haytham was very puzzled by the equant, and eventually disproved it mathematically, just as he had the first mathematical explanation of twilight and other phenomena. As Ibn al Haytham wrote in his Doubts about Ptolemy,

"Ptolemy assumed an arrangement (hay'a) that cannot exist, and the fact that this arrangement produces in his imagination the motions that belong to the planets does not free him from the error he committed in his assumed arrangement, for the existing motions of the planets cannot be the result of an arrangement that is impossible to exist... [F]or a man to imagine a circle in the heavens, and to imagine the planet moving in it does not bring about the planet's motion." 10

Had Ibn al Haythamlived longer, perhaps he might have figured out that the solar system was sun-centered. Other Arab Muslim thinkers might also have made the same discovery, but if they did, there is no definitive evidence that they did. Credit goes



The Answer - Ludwig Deutsch (1855-1935).

to Copernicus in his *De revolutionibusorbiumcoelestium (On the Revolutions of the Celestial Spheres)* published just before his death in 1543.Galileo's advocacy of heliocentrism decades later caused him to be convicted of heresy by the Catholic Church in 1633. His judgementstood for 350 years -- until 1992 when he was officially pardoned by the Church.

Natural selection of species and evolution: intuited by al Jahiz, proven by Darwin

One of the key scientific concepts of the modern world is the theory of evolution and natural selection of species. It underpins the modern understanding of the growing evolutionary complexity of life from the firstbiological organisms 3.5 billion years ago, to marine creatures, insects, amphibians, reptilians, mammals, primates and finally the human race itself. Modern recognition for this theory is generallygiventoCharles Darwin in the UK, although another British scientist, Alfred Russell Wallace, coincidentally came up with the same theory at the same time as Darwin and they co-published their first paper in 1858 CE.

Ancient Arab manuscripts show that the two Englishmen were not the first to articulate this concept. In the hot and swampy Tigris delta port city of Basra, Iraq 1,200 years ago, there was a conspicuous man named Abu Uthman Amr ibn Bahr al-Kinani al-Fuqaimi al-Basri, who voiced a similar theory.

He was known to his friends as al Jahiz – "the boggle eyed"-- and he was quite extraordinary.

He was the grandson of slaves from East Africa, with roots in Ethiopia, Zanzibar, Tanzania and the Sudan.11

He grew up on the fetid canals of working-class Basra, helping support his family by working as a child fishmonger. For that starting point,al Jahiz became the first scholar of sub Saharan African descent to achieve eminence within the frame of the young culture of Islam. This fishmonger taught himself to read and write, and he did so with such eloquence that he rose to the attention of the mighty caliph al Mamun in Baghdad, and so was invited to work in the Bayt al Hikmat.

He was the first black man to achieve this kind of scholarly recognition in Islamic Iraq, and he did it entirely on his own.He wrote at least 200 scholarly papers, about 30 of which survive in the 21st century, held in a library in Milan, Italy.

He did all this entirely by his raw ambition, intelligence and eloquence, because for all his brilliance and energy, he was not an attractive man. He was abrupt, wide-faced and squat, and he spoke in intense bursts and did not suffer fools. He was not deferent to those in power or with higher social standing, but rather spoke his mind no matter the consequence.

This man was a force of nature. And whereas most men, certainly those born into poverty and facing barriers than would deter even the strongest and most talented, this thinker easily surmounted them. It was as if those barriers did not apply to him, and so he ignored them.

In fact, he laughed his way through them. Together with his brilliance, it was his humor that saved the day. Whereas lesser men would stammer and flail at the many obstacles they faced, al Jahiz always knew how to tell a good story or joke, and how to get everybody from caliphs to religious inquisitors to laugh along with him.

Even when his jokes weren't that funny, his guttural laughter at his own jokes was so infectious that no one knew the difference, and they laughed with him.It was a good thing that he could tell a joke and get people to laugh, because this very special man spouted the most provocative theories.12

He began to articulate the geographic and climatological impact on African human evolution:

They are the sons and daughters of the sun which has made them so black. One of them will lift huge blocks and carry heavy loads that would be beyond the strength of most Bedouins or members of other races. They are courageous, energetic, and generous, which are the virtues of nobility, and also good-tempered and with little propensity to evil. They are always cheerful, smiling, and devoid of malice, which is a sign of noble character.

The Zanj say that God did not make them black in order to disfigure them; rather it is their environment that made them so. The best evidence of this is that there are black tribes among the Arabs, such

as the BanuSulaim bin Mansur, and that all the peoples settled in the Harra, besides the BanuSulaim are black. These tribes take slaves from among the Ashban to mind their flocks and for irrigation work, manual labor, and domestic service, and their wives from among the Byzantines; and yet it takes less than three generations for the Harra to give them all the complexion of the BanuSulaim. This Harra is such that the gazelles, ostriches, insects, wolves, foxes, sheep, asses, horses and birds that live there are all black. White and black are the results of environment, the natural properties of water and soil, distance from the sun, and intensity of heat. There is no question of metamorphosis, or of punishment, disfigurement or favor meted out by Allah. 13

And yet there was even more to this man. Because as best as can be determined, he was the first person to articulate and record a theory of the natural selection of species.

Although Darwin and Wallace were given credit for first describing the natural selection of the species in their visionary work On the Origin of the Species in 1858, 1,000 years before Darwin, in 830 CE, al Jahiz wrotea visionary work, *Kitab al-Hayawan (Book of Animals).*

Conway Zirkle, writing in 1941, said that an excerpt from this work was the only relevant passage he had found from a pre modern Arab on the subject of natural selection. He quoted from a Spanish translation of *the Book of Animals* as follows:

"The rat goes out for its food, and is clever in getting it, for it eats all animals inferior to it in strength", and in turn, it "has to avoid snakes and birds and serpents of prey, who look for it in order to devour it" and are stronger than the rat. Mosquitos "know instinctively that blood is the thing which makes them live" and when they see an animal, "they know that the skin has been fashioned to serve them as food". In turn, flies hunt the mosquito "which is the food that they like best", and predators eat the flies. "All animals, in short, cannot exist without food, neither can the hunting animal escape being hunted in his turn. Every weak animal devours those weaker than itself. Strong animals cannot escape being devoured by other animals stronger than they. And in this respect, men do not differ from animals, some with respect to others, although they do not arrive at the same extremes. In short, God has disposed some human beings as a cause of life for others, and likewise, he has disposed the latter as a cause of the death of the former." 14

In another translation, al Jahiz wrote:

"Animals engage in a struggle for existence; for resources, to avoid being eaten and to breed. Environmental factors influence organisms to develop new characteristics to ensure survival, thus transforming into new species. Animals that survive to breed can pass on their successful characteristics to offspring" 15

He would describe food chains ... the first such scholarly writings now documented:

"The mosquitoes go out to look for their food as they know instinctively that blood is the thing which makes them live. As soon as they see the elephant, hippopotamus or any other animal, they know that the skin has been fashioned to serve them as food; and falling on it, they pierce it with their proboscises, certain that their thrusts are piercing deep enough and are capable of reaching down to draw the blood. Flies in their turn, although they feed on many and various things, principally hunt the mosquito ... All animals, in short, cannot exist without food, neither can the hunting animal escape being hunted in his turn"

Although this self-taught scholar and sometime royally-funded polemicist was obviously not without blemish and imperfection, intellectually he was about 1,000 years ahead of his time in thinking about how life evolved on earth.

His ideas would not resurface for a millennium until Darwin, after years of work and a five-year voyage on HMS Beagle, would finally articulate his theory of the natural selection of species. As Darwin wrote,

"In October 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had at last got a theory by which to work.

As many more individuals of each species are born than can possibly

survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form

*There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved"*16

This theory, later validated and elaborated by multiple streams of scientific research, would nonetheless remain controversial in many quarters for a century and a half after Darwin's death.

Although perhaps expressed more elegantly than al Jaḥizand backed up by years of focused research and supporting data, within Darwin's theory could be found the shadow of al Jahiz' from 1000 years before. Al Jahiz achieved this biological insightat a time when Europe was a slumbering backwater, still stuck in the Dark Age depression caused by the fall of Rome. In the time of al Jahiz, India and China, ancient and rich civilizations, were in relative decline, still enormously wealthy and powerful but having temporarily surrendered intellectual discovery to the Muslim world. Al Jahiz did his work seven centuries before the theories of Kepler and Galileo and Newton and many others whom the modern world now considers the fathers of modern empirical science. He did his work far outside the frame of Renaissance and Enlightenment Europe.He did this when the desert religion and culture of Islam was barely 200 years old.

Theory of relativity: intuited by al Kindi, articulated by Einstein

This article earlier noted that Einstein's theory of relativity is perhaps the highest intellectual achievement of the modern era. Its mathematical formulation, E= MC2, and all the resulting derivatives, has led to the most advanced discoveries about the atom, nuclear fission and fusion, thermonuclear weapons, astrophysics, the Big Bang theory, a concept of the structure of the universe, the space-time continuum and much more. Its concepts are so complicated and esoteric that only a tiny fraction of the human race can even understand them.

Yet this visionary theory had been voiced, albeit in much simpler fashion and without the mathematical proof, 1000 years before Einstein, by another Arab Muslim thinker just as al Jahiz was ending his life.

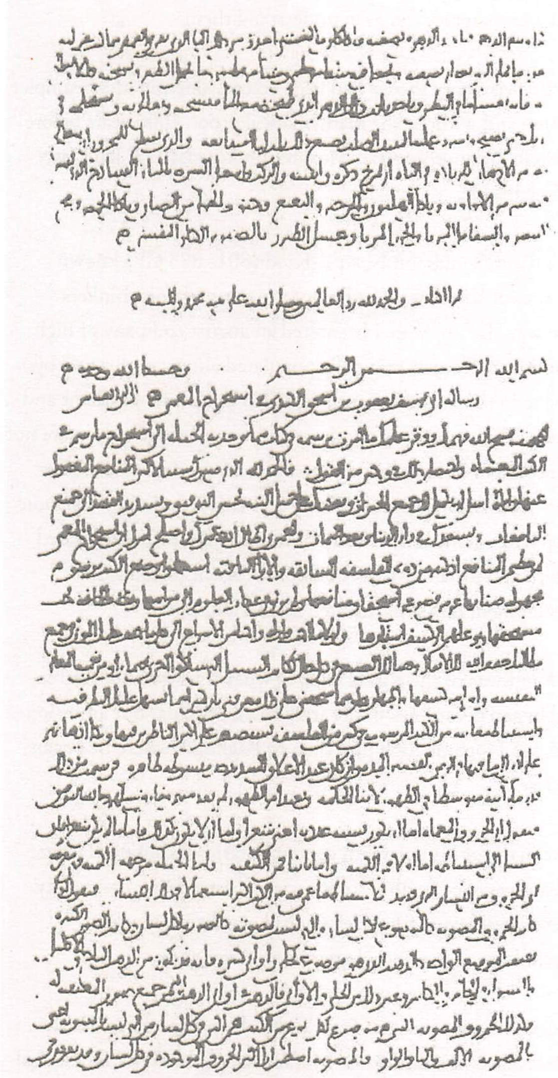
AbūYūsufYa'qūb ibn Isḥāq al-Kindī(801–873 CE) known today as al Kindi, was the first of the great Islamic thinkers who was also an Arab. He entered an august company of high Islamic intellectuals originally populated almost exclusively by urbane Persians and Levantines, exiled Byzantines, Indians and others. This was not to say the world-conquering Arabs were not as intelligent as the other nationalities of the day -- but rather that Arabs until 632 were largely non-urban and often nomadic people not granted the luxury of fertile climates, concentrated wealth and urban division of labor sufficient to allow the development of a sophisticated intellectual class.

Al Kindiwas of the Kinda tribe in what is now Saudi Arabia, and began his studies in the Iraqi town of Kufa. But ambition and good fortune took him then to Baghdad, where he began his rise.

Like many of his polymath contemporaries including al Jahiz, al Kindi exceled in philosophy, science, astronomy, cosmology, chemistry, logic, mathematics, music, medicine, physics, psychology, and meteorology just to name a few.

A devout rationalist and free thinker, he prospered under the patronage of the rationalist Mutazilite caliphs al Mamun and al Mutasim, and suffered persecution and internal exile during the traditionist reign of al Mutawakkil.

While he was an early pioneer in many fields, such as minerology, chemistry, tints and cosmetics -- and especially cryptography, including his work with numerical pattern recognition that reaches its flowering 1000 years later in the Allied code breaking of World War II – he was also a bridge between ancient Hellenistic philosophy and evolving Islamic thought. He translated Greek scientific and philosophical works and saw no contradiction between the Greek tradition and the evolving Islamic thought.



The first page of al-Kindi's manuscript "On Deciphering Cryptographic Messages", containing the oldest known description of cryptanalysis by frequency analysis.

All that merits recognition. But what made him especially intriguing is an intuitive statement by al Kindi in the mid 800s.

He called it his "theory of relativity" and he expressed it this way:

Time exists only with motion; body with motion; motion with body … if there is motion, there is necessarily body; if there is a body, there is necessarily motion. 17

As for the influence of al Kindi on Einstein, it is highly unlikely that Albert Einstein, as broad and iconoclastic thinker as he was, would have been delving into Islamic physical theory from 10 centuries before. It was most likely a case of parallel discovery, separated by 1,000 years of time.

It is supremely intriguing that all these futuristic and intuitive statements of modern science happened once again in the dust of long-buried Abbasid Iraq, long before computers, electricity, calculators and telescopes.

As seen in the preceding, many of the foundations of the modern world rest in Arab Muslim history. 19th and 20th centuryhigher mathematics, the modern scientific method, natural selection of species and the theory of relativity can find precedent in 9th century Baghdad, 11th century Cairo and other ancient cities.

But even older civilizations like China, India, Byzantium, Persia, Mesopotamia and Egypt also helped fertilize the thinkers of the modern world, in many cases by stimulating invention in the Arab Muslim world,which in turn seeded the European Renaissance.

Put another way, as stated at the beginning of this article, while there are ebbs and flows in the frequency and quality of invention, genius is not restricted to any historical era, race, nation, geography or religion. It is part of being human.

If one looks at the historical record without national or cultural bias, it is obvious that Arab Muslim civilization provided additional, equally important foundations for the modern world: evidence-based medicine, attempts to create artificial life,computation using the human brain and others, to name a few.

Perhaps the highest challenge for the modern world, which tends

to look only to the near past, present and the future, is to learn the value in looking backward too, into history. In doing so, it may be rediscovered that advanced thinking and vision are traits of all humans, present and past. The only difference is that now, the world finally has many of the technological tools to attempt and verify what once was only imaginary.

CITATIONS

1. «Europa».In: **Zedlers Universal-Lexicon,** Volume 8, Leipzig 1734, columns 2192–2196 (citation: column 2195).

2. George Modelski, World Cities: –3000 to 2000, Washington, D.C.: FAROS 2000, 2003.ISBN 978-0-9676230-1-6. See also Evolutionary World Politics Homepage and Trudy Ring, Robert M. Salkin, K. A. Berney, Paul E. Schellinger (1996)."International dictionary of historic places, Volume 4: Middle East and Africa". Taylor and Francis: 116.

3. Rashed, Roshdi (2007),"The Celestial Kinematics of Ibn al-Haytham", Arabic Sciences and Philosophy (Cambridge University Press) 17: 7–55, doi:10.1017/S0957423907000355

4. Karpinski, L. C. (1912)."History of Mathematics in the Recent Edition of the Encyclopædia Britannica". American Association for the Advancement of Science

5. http://www.oxforddictionaries.com/definition/english/scientific-method.

6. Konigsveld, Ronald; Stockmayer, Walter Hl. Nies, Erik (2001), Polymer Phase Diagrams: A textbook, Oxford University Press, pp xii-xiii, ISBN 0198556349

7. . Kraus, Paul, Jabir ibn Hayyan, Contribution al'histoire des ideesscientifiquesdansl'Islam. I. Le corpus des ecritsjabiriens. II. Jabir et la science grecque, Cairo (1942-43). Reproduced by FuatSezgin (Natural Sciences in Islam. 67-68, Frankfurt. 2002 (cf. Ahma Y Hassan."A Critical Reassessment of the Geber Problem: Part Three".

8. Angelo, Joseph (2009). Encyclopedia of Space and Astronomy, p 78

9. (Sabra, A. I., ed. (1989), The Optics of Ibn al-Haytham. Books I-II-III: On Direct Vision. English Translation and Commentary. 2 vols, Studies of the Warburg Institute 40, Translated bySabra, A. I., London: The Warburg Institute, University of London, ISBN 0-85481-072-2,OCLC 165564751 165564771 180528350 180528355 180528359 21530166 230045836 24910015 59836570

10. Sabra, A. I. (1978b),"An Eleventh-Century Refutation of Ptolemy's Planetary Theory", in Hilfstein, Erna; Czartoryski, Paweł; Grande, Frank D., Science and History: Studies in Honor of Edward Rosen, StudiaCopernicana XVI, Ossolineum, Wrocław, pp. 117–131

11. Al-Jahiz messages, Alwarraq edition, page 188; Yāqūt, Irshād al-arībiláma`rifat al-adīb, ed. Iḥsān `Abbās, 7 vols (Beirut: Dār al-Gharb al-Islāmī, 1993), 5:2102. And ChuoKikuu cha Dar es Salaam. Chuo cha UchunguziwaLughaya Kiswahili (1974). Kiswahili.East African Swahili Committee. p. 16.;Yāqūt,Irshād al-arībiláma`rifat al-adīb, ed. Iḥsān `Abbās, 7 vols (Beirut: Dār al-Gharb al-Islāmī, 1993), 5:2102.

12. http://www.muslimphilosophy.com/ei2/JAHIZ.htm

13. Medieval Sourcebook:AbûÛthmân al-Jâhith: From The Essays, c. 860 CE.Retrieved 2 October 2014.

14. Zirkle C (1941)."Natural Selection before the"Origin of Species". Proceedings of the American Philosophical Society 84 (1): 71–123.

15. Kitāb al-Hayawān, 'Abd al-SalāmHārūn, ed., 2nd ed., 7vols. (Cairo, 1938-1945)

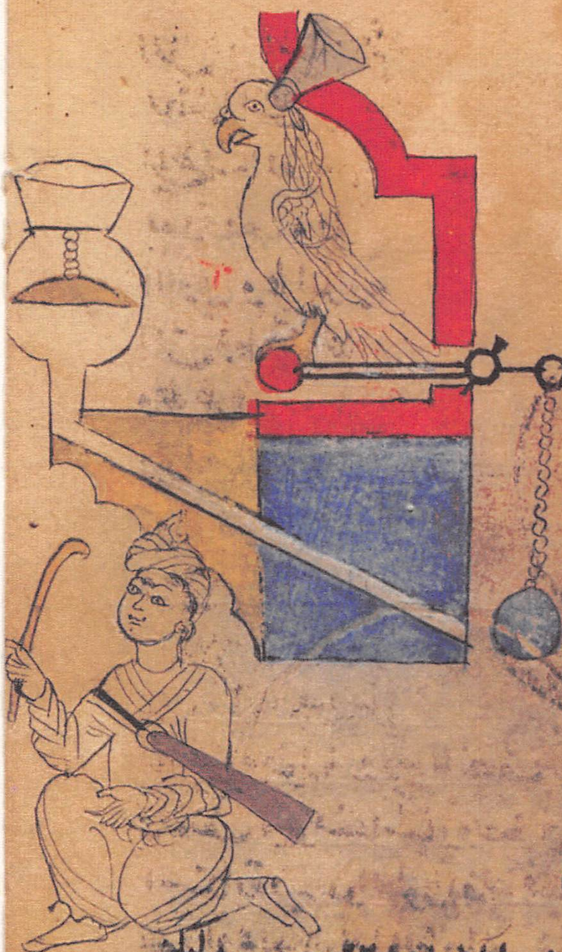
16. Darwin, Charles (1859). On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life (1st ed.). London: John Murray.ISBN 1-4353-9386-4.Retrieved 24 October 2008.

17. Al-Kindi, Al-Falsafa al-Ula, ed. M ARida, Cairo, 1950, Vol. 1;

فى سكرجة جالسة ثابتة فى طرف الحاب ونقلا عنه وسكرجة
اخري منطبقة علي الطرف الاعلى ثم يتخذ قماط من ادم
ماهو طول وعرضه ما يستر الحابات ويوثق طرفه من
المحقة المنصب على سمت الجامات ويدار المحقة ليلتف
عليه القماط كالدرج ويشد طرفه الاخر في ومطاهر
العجلة فمن اول الميدان وللسفود المتنصب عليها
يحاذي طرف اول جامة ومتى سارت العجلة فان
القماط ينتشر وينشر جامة بعد اخرى حتى ينشر
جميع الجامات وهذه صورة المحقة ::

وعليه ح وللسكرجتين وعليهما م م والقماط وعليه
ع وطرفه فى سفود العجلة وعليه س وهو منتشر واما
مواضع الكرات الاثني عشرة فتتخذ لها مواضع على
ما تقدم في الشكل الاول وتلك الخشبة العليا في عرضها
ثمانية ثقبان وليكن لهذه ثقب والشفرات
على ما تقدم وزيادة وهي ان تشد في ثقب ذنب
كل شفرة خيط طوله نحو شبر واحد وفي طرفه ثقالة
من رصاص اثقل من الشفرة ويعارض دون
ابواب الشفرات خشبة فيها اثنا عشر من اما على ما تقدم
في الشكل الاول لتعلق فيها الثقالات ثم تتخذ ب ١٠ اسفل كل ثقالة

A page of the Manuscript of "Al-Hiyal" (Mechanical tricks) by Al-Jazari



فلنعمل صليبا والبواقي الصاعد
الي صورته اذ ليس لها حركة وصوق
يخرج من جهة اخرى
الفصل السابع
في كيفية عمل الوسايط المحركة
بجميع ما ذكرناه في الابواب
الاولى والثانية والهلال
على الافريز دون الابواب
الثانية والبازيان في علمان
الليل فقط لمن اراد ان
تقتصر على ذلك يحمل البيت تابت
يدخل منه ويعمل في وسط البيت
بركة من نحاس ينتهي اليها ما يخرج
من الخانات وكثير من ذلك فيم
ثم تنصب اله الماء اعني الخانة
والربع والدستور المعقوم لمخرج الماء على ما تقدم وصفه ولكن
الخانة عن عمق الحجاب ولكن ما يخرج من مخرجه من الماء
على ارض صلبة الى البركة ثم تتخذ من الخشب الصلب
اليابس قرص كالترس في غاية الاستواء لكن قطره ثلثة
اشبار ونصف وزيادة نصف ظفر وسمك اصبعين ويسوى
ثم يخرج قطره من وجه واحد بخط مور ويدار على مركزه
دائرة قطرها ثلثة اشبار ونصف ثم دائرة اخرى قطرها
شبران ثم نقطع من طرفه على خط قطره الى صدر الدائرة القائمة

الني

صفحة من مخطوط الحيل الميكانيكية للجزري